time and increases it at another, and it is also shown that the times of this diminution and increase correspond respectively to the periods when the vagus causes a diminution and increase of the size of the contractions.

The action of the vagus upon the muscular tissue of the ventricle is further shown by its power of removing the inequalities in the size of the ventricular contractions, when as often happens, the ventricle is beating with alternately strong and weak contractions.

Stimulation of the nerve causes this inequality to disappear when it increases the force of the contractions, and to reappear again when it diminishes that force.

The effect of stimulation of the vagus upon the tonicity of the ventricle was studied by the method described elsewhere,* and the author shows that the relaxation between the beats of the ventricle is increased during the stimulation of the nerve, even although the rate of rhythm is not made slower.

The conclusion therefore is drawn, that stimulation of the vagus acts upon the muscular tissue of the ventricle in such a way as to diminish its excitability and lower its tonicity, when it reduces the force of the ventricular contractions, while it increases its excitability and possibly also increases its tonicity when it augments the contraction force.

Finally, it is shown that atropin removes the whole action of the vagus stimulation, and the effects of the local application of curare, muscarin, and atropin are described and discussed.

In conclusion, the author sums up the results of these experiments, and suggests that a series of formative processes are going on in both the muscular tissue and the motor ganglia of the heart, similar to those which occur in gland-cells, and that the vagus produces all its effects by increasing the activity of these processes and not because it contains a multiplicity of fibres, each of which possesses a different function.

III. "On Melting Point."   By EDMUND J. MILLS, D.Sc., F.R.S., Young Professor of Technical Chemistry in Anderson's College, Glasgow.   Received December 6, 1881.

(Abstract.)

The investigation, of which the memoir contains an account, was undertaken in order to determine, with considerable accuracy, the

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* "Journal of Physiology," vol. i, p. 452.

temperature at which certain organic substances pass from the solid to the liquid state.

The apparatus, of which an engraving, on a scale of one-fourth,* is given below, consists of a bath nearly filled with oil of vitriol. In this is
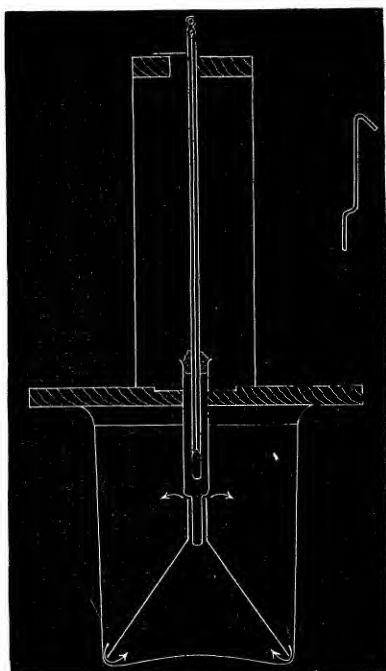
inserted a glass funnel, having on its lower edge six equidistant semi-circular cuts of about 5 millims. radius, and, at the end of the neck, four of the same. A thin test-tube, resting freely on the funnel, contains a bath of paraffin oil, in which the thermometer's bulb is centrally placed; against the bulb, in a little tube separately represented, is fixed the substance whose melting point is to be determined. When the large bath is heated, constrained and regular convection takes place in the liquid; the effect upon the thermometer is such as to cause the mercury to rise with very great steadiness.

A preliminary series of researches in thermometry has enabled me to give a series of results completely corrected, and in terms of the air thermometer.

* The portion above the cover of the bath is not to scale.

Substance.	Weighted, mean.	After Poggendorff's correction.	Air therm.
Toluidine	42 ·765	42 ·700	42 ·890
Nitrophenol (*a*)	44 ·270	44 ·205	44 ·392
Nitrotoluol	51 ·305	51 ·239	51 ·407
Dichlorobenzol	52 ·723	52 ·657	52 ·821
Nitronaphthalin	56 ·175	56 ·110	56 ·261
Dinitrophenol (*a*)	61 ·778	61 ·714	61 ·843
Monobromaniline.....	61 ·806	61 ·742	61 ·871
Dinitrotoluol (*a*)	69 ·211	69 ·154	69 ·252
,, (*b*)	69 ·571	69 ·514	69 ·610
Monochloraniline.....	69 ·667	69 ·610	69 ·706
Dinitrobromobenzal...	70 ·598	70 ·542	70 ·634
Trichloraniline	77 ·052	77 ·004	77 ·068
Dibromaniline........	78 ·821	78 ·776	78 833
Trinitrotoluol	78 ·841	78 ·796	78 ·853
Naphthalin	80 ·061	80 ·018	80 ·070
Trinitrotoluol (M)....	80 ·524	80 ·481	80 ·532
Nitrodibromobenzol...	83 ·490	83 ·452	83 ·492
Dibromobenzol.......	87 ·037	87 ·007	87 ·035
Dinitrobenzol	89 ·718	89 ·693	89 ·712
Nitrophenol (*b*)	111 ·413	111 ·448	111 ·455
Dinitrophenol (*b*)	111 ·579	111 ·614	111 ·621
Tribromaniline.......	116 ·247	116 ·298	116 ·319
Trinitrophenol	121 ·082	121 ·151	121 ·194

Mean probable error of a result, in terms of the air thermometer, $0°·015$.

The method of purification adopted was based upon what may be termed the principle of *multiple successive solvents*. It is well known that small quantities of impurities are prone to cling to substances with great tenacity; but the observation has most frequently been made in connexion with a single solvent. One can readily conceive that the tenacity with which a given trace of a foreign body is held, under such circumstances, may be in effect constant. If, however, we now transfer the mixture to a second solvent, it may be presumed that the trace will be in a condition of altered adhesiveness, and may be much more readily separable. In accordance with this principle the substances were crystallised from two solvents at least, and the constant melting points of successive fractions recorded. After every fractional crystallisation, pressure was had recourse to for about twelve hours.

A glance at the table shows that, on the whole, melting point and formula grow together. The following instances of this law (M.P. = *m* Formula) are adduced:—

Substance.	Formula.	M. P.	m.
Dichlorobenzol	$C_6H_4Cl_2 = 147$ ..	52·821 ..	·3593 3
Bromaniline	$C_6H_6BrN = 172$ ..	61·742 ..	·35971
Trinitrotoluol......	$C_7H_5N_3O_6 = 227$ ..	80·532 ..	·35477

Here the first pair of values of m are almost identical. It is evident, however, that this simple relation does not generally prevail; indeed, in the case of isomeric substances, melting point may alter widely, while additive formula remains constant.

The following are examples of the identification of series by melting point :—

	M. P.		M. P.	
x-Trinitrotoluol......	78·853 —	x-Dinitrotoluol	$69 \cdot 252 = 9 \cdot 601$	⎫
Trinitrophenol.....	121·194 —	β-Dinitrophenol	$111 \cdot 621 = 9 \cdot 573$	⎬

x-Dinitrotoluol	69·252 —	Nitrotoluol	$51 \cdot 407 = 17 \cdot 845$	⎫
x-Dinitrophenol......	61·843 —	x-Nitrophenol	$44 \cdot 392 = 17 \cdot 451$	⎬

The melting points recorded in the memoir are important physical constants, now first determined with a small probable error, and with an apparatus of considerable simplicity. Under no range of ordinary atmospheric pressure or latitude, and in no ordinary interval of time, are these constants likely to become impaired. Hence, if the substances referred to be prepared and preserved with average care, and handled with moderate skill, they constitute in themselves a set of thermometric standards, distributed at mean intervals of about $4°$ between $42°$ and $120°$. If these substances, or most of them, be at hand, they enable an investigator to at once calibrate and directly refer to the air thermometer any standard mercurial instrument, without the necessary application of any correction whatever.

IV. "Memoir on the Theta-Functions, particularly those of Two Variables." By A. R. FORSYTH, B.A., Fellow of Trinity College, Cambridge. Communicated by A. CAYLEY, LL.D., F.R.S. Received December 9, 1881.

(Abstract.)

The paper of which this is an abstract is divided into four parts, to the whole being prefixed a list of the more important papers dealing with the double theta-functions.

Section I treats of what may be called Rosenhain's theory, and its object is to obtain from a more general basis, and in an easier manner, the results given by Rosenhain in his essay " Mémoire sur les Fonctions des Deux Variables et à Quatre Périodes," which obtained the